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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/666,523	09/22/2003	Luc Wolff	PET-2102	5857

23599 7590 07/02/2007
MILLEN, WHITE, ZELANO & BRANIGAN, P.C.
2200 CLARENDON BLVD.
SUITE 1400
ARLINGTON, VA 22201

EXAMINER

SINGH, PREM C

ART UNIT	PAPER NUMBER
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1764

MAIL DATE	DELIVERY MODE
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07/02/2007

PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No. 10/666,523	Applicant(s) WOLFF ET AL.	
	Examiner Prem C. Singh	Art Unit 1764	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 19 April 2007.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 21-42 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 21-27 and 39-42 is/are rejected.
- 7) ☐ Claim(s) 38 is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 11 July 2006 is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some * c) ☐ None of:
1. ☒ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------|
| 1) <input type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | 5) <input type="checkbox"/> Notice of Informal Patent Application |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08)
Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

Response to Amendment

1. Objection to claim 21 and rejection of claim 25 under 35 U.S.C. 112, second paragraph, is withdrawn.
2. Amendment to claims 21 and 25 is noted.

Claim Rejections - 35 USC § 103

3. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

4. The factual inquiries set forth in *Graham v. John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

5. This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of

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the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

6. Claims 21-37, and 39-42 are rejected under 35 U.S.C. 103(a) as being unpatentable over Magne-Drisch et al (US Patent 6,369,287) in view of Lee (US Patent 3,306,942).

7. With respect to claims 21 and 22, Magne-Drisch invention discloses a process for co-producing ethyl benzene and paraxylene, which comprises the following steps:

A feedstock that is provided via a supply line (1) and comprises a mixture of p-xylene, o-xylene, m-xylene, and ethyl benzene is introduced into a first adsorption unit (2). This unit comprises chromatographic columns that are filled with an adsorbent, and it operates according to the principle of a simulated counter-current moving bed. Said unit comprises four chromatographic zones. A raffinate that consists essentially of o-xylene and m-xylene and ethyl benzene and desorbent is recovered via a line (3). The desorbent which is toluene that is introduced via a line (6a) makes it possible to desorb via a line (4) an extract that consists of essentially pure p-xylene and toluene that is distilled and recycled (not shown in the Figure) (See column 5, lines 9-22). The raffinate

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is sent via line (3) into a distillation column (5) which feeds a toluene distillate via a line (6) that is optionally recycled and a residue. The latter is introduced via a line (7) into a second adsorption unit (8) that operates as first unit (2), according to the principle of the simulated countercurrent moving bed. A raffinate that contains desorbent and m-xylene and o-xylene is drawn off via line (10) while an extract that contains basically essentially pure ethyl benzene and desorbent is desorbed by the toluene that is introduced via a line (12 a). This draw-off is carried out via a line (9) downstream from the line for introducing desorbent into unit (8) (See column 5, lines 23-37). The raffinate is sent into a distillation column (11) that feeds a toluene distillate via a line (12) and a residue of o-xylene and m-xylene via a line (13). At least a portion of this residue can be introduced into a distillation unit (18) via a line (17). Said unit (18) makes it possible to recover an essentially pure m-xylene distillate via a line (19) and an essentially pure o-xylene residue via a line (20). The other portion of the residue is sent into an isomerization unit that operates with or without hydrogen that is introduced via a line (15). The isomerate that is collected via a p-xylene-enriched line (16) essentially contains no ethyl benzene and is mixed at line (1) (See column 5, lines 39-54). Also, preferably by a standard method that is not shown in the figure, at least some of C₉+ compounds are eliminated from the isomerate (See column 5, lines 56-59).

It is to be noted that Magne-Drisch invention does not specifically mention about a distillation column (2) as claimed, but the invention does mention separation of C₉+ compounds from the isomerate which eventually becomes feed for the adsorption unit. Thus, it would have been obvious to one skilled in the art at the time then invention was

made to modify Magne-Drisch invention and add a distillation unit before the adsorption step as claimed to eliminate C₉+ compounds.

Magne-Drisch invention discloses that the ethyl benzene production line is generally integrated into a plant for producing styrene (See column 2, lines 35-37), but it does not disclose dehydrogenation step of ethyl benzene to styrene.

Lee invention discloses an improved process for the dehydrogenation of alkyl aromatic hydrocarbons such as ethylbenzene to styrene (see column 1, lines 9-12).

Thus, it would have been obvious to one skilled in the art at the time the invention was made to modify Magne-Drisch invention by including a dehydrogenation step as suggested by Lee and take the stream (9) consisting of 99% pure ethylbenzene (See column 8, line 26) and convert it to styrene to make the process more profitable and useful due to numerous applications of styrene.

8. With respect to claim 23, Magne-Drisch discloses, "A raffinate that consists essentially of orthoxylene and metaxylene and ethyl benzene and desorbent is recovered line (3). The desorbent which is toluene that is introduced via line (6a) makes it possible to desorb via a line (4) an extract that consists essentially of pure paraxylene and toluene that is distilled and recycled (not shown in the figure)." (Column 5, lines 17-23).

9. With respect to claim 24, Magne-Drisch discloses in the figure adsorption column (2) operating in 5 zones. The figure showing streams (3), (3a), (4), (6a), and

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combination ((1) and (16)) of Magne-Drisch respectively represent the claimed streams (7c), (7b), (7a), (5), and (3).

10. With respect to claim 25, Magne-Drisch discloses in the figure where the first raffinate product (3a) is distilled in distillation column (11) to eliminate toluene (12), and then taken to the isomerization zone (14). The second raffinate product (3) goes to the distillation column (5) to remove toluene (6) and then to the second adsorption column (8). It is to be noted that stream (3) comprises essentially of orthoxylene, metaxylene, ethyl benzene, and toluene. Although the figure does not show a dehydrogenation unit, since the stream contains ethyl benzene, it would have been obvious to one skilled in the art at the time the invention was made to modify Magne-Drisch invention and take the stream (7) to a dehydrogenation unit to convert ethyl benzene to styrene to make the process more profitable by producing styrene.

11. With respect to claims 26 and 27, Magne-Drisch discloses the adsorbent used in the first adsorption column to be X zeolite exchanged with barium or a Y zeolite exchanged with potassium and barium (See column 4, lines 43-45) and titanasilicate containing adsorbent in the second column (See column 4, lines 66-67).

Although Magne-Drisch does not disclose using X or Y zeolites in the second adsorption column but it would have been obvious to one skilled in the art at the time the invention was made to modify Magne-Drisch invention and use X or Y zeolites because they are functionally similar to the adsorbent disclosed by Magne-Drisch.

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12. With respect to claims 28 and 29, Magne-Drisch discloses the desorbent of the first and second adsorption columns as toluene or paradiethylbenzene (See column 4, lines 39 and 58).

13. With respect to claim 30, Magne-Drisch discloses the volumetric ratio of desorbent to feedstock for the first adsorption column = 1-2 and for the second adsorption column = 1-3 (See column 4, lines 36-37 and line 59).

14. With respect to claim 31, Magne-Drisch discloses the first adsorption temperature = 100-200°C and pressure = 2-30 bar (See column 4, lines 34-35).

15. With respect to claim 32, Magne-Drisch discloses the second adsorption temperature = 100-200°C and pressure = 2-30 bar (See column 4, lines 56-57).

16. With respect to claim 33, Magne-Drisch discloses that the first adsorption column contains 6-24 number of beds (See column 4, line 38) and 4 zones (see column 5, lines 15-16). Thus clearly, each zone has more than 3 beds.

17. With respect to claim 34, Magne-Drisch discloses that the second adsorption column contains 6-24 number of beds (See column 4, lines 53-54) and 4 zones (See column 5, lines 31-32).

Although Magne-Drisch does not specifically mention the number of beds in the second zone, but it would have been obvious to one skilled in the art to keep required number of beds, including the number as claimed, in the second zone for an effective separation.

18. With respect to claim 35, Magne-Drisch discloses, "A process for separation of p-xylene by adsorption (US 2,985,589 and US 3,626,020), whose effluents are p-xylene, on the other hand, and an aromatic C8 fraction that is substantially free of p-xylene, on the other hand. Crystallization can be combined with the adsorption stage to obtain p-xylene that is more pure." (Column 1, lines 13-22).

Although Magne-Drisch does not disclose the details of the crystallization process and recycle of mother liquor to the separation column, it would have been obvious to one skilled in the art at the time the invention was made to modify Magne-Drisch invention and recycle the mother liquor to enhance the production of paraxylene.

19. With respect to claim 36, Magne-Drisch does not specifically mention about a distillation column (2) as claimed but suggests a separation unit before adsorption as discussed under claim 21.

Thus, it would have been obvious to one skilled in the art at the time the invention was made to modify Magne-Drisch invention and include a distillation column before adsorption step. Also, it would have been obvious to take the separated C₉+ fractions in a distillation column for final recovery of any xylenes.

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20. With respect to claim 37, Magne-Drisch discloses a separation step (8) of adsorption for stream (7) which is equivalent to the claimed step (20) for the claimed stream (18).

21. With respect to claims 39, 40, and 42, Magne-Drisch discloses in the figure stream (13) which is equivalent to the claimed stream (23b). The figure also shows stream (13) going to the isomerization zone (14) which is equivalent to the claimed isomerization zone (24).

Magne-Drisch further discloses, "Because the recycling of the isomerate that contains very little ethyl benzene in said unit leads to a reduction in the concentration of ethyl benzene of the adsorption feedstock." (Column 3, lines 25-29).

Magne-Drisch also discloses, "The process of invention can be used in liquid phase or in gas phase." (Column 7, lines 1-2).

Although Magne-Drisch invention does not specifically mention about quantitative value of ethyl benzene, it does mention "very little", thus it would have been obvious to one skilled in the art at the time the invention was made to modify Magne-Drisch invention and use ethyl benzene content less than the claimed concentration to reduce load on the adsorption columns.

22. With respect to claim 41, Magne-Drisch discloses, "The mixture that is treated in the zone for separating xylenes (2) consists of 28 wt % fresh feedstock (line 1) and 72

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wt % by weight of aromatic compounds with 8 carbon atoms that are obtained from the effluent of the isomerization zone (line 16)." Column 7, lines 40-44).

Although Magne-Drisch does not use a distillation column (2) as claimed, but as discussed under claims 21 and 36, it would have been obvious to one skilled in the art at the time the invention was made to modify Magne-Drisch invention and use a distillation column to remove C₉ and higher components from the feed prior to adsorption step.

Double Patenting

23. The nonstatutory double patenting rejection is based on a judicially created doctrine grounded in public policy (a policy reflected in the statute) so as to prevent the unjustified or improper timewise extension of the "right to exclude" granted by a patent and to prevent possible harassment by multiple assignees. A nonstatutory obviousness-type double patenting rejection is appropriate where the conflicting claims are not identical, but at least one examined application claim is not patentably distinct from the reference claim(s) because the examined application claim is either anticipated by, or would have been obvious over, the reference claim(s). See, e.g., *In re Berg*, 140 F.3d 1428, 46 USPQ2d 1226 (Fed. Cir. 1998); *In re Goodman*, 11 F.3d 1046, 29 USPQ2d 2010 (Fed. Cir. 1993); *In re Longi*, 759 F.2d 887, 225 USPQ 645 (Fed. Cir. 1985); *In re Van Ornum*, 686 F.2d 937, 214 USPQ 761 (CCPA 1982); *In re Vogel*, 422 F.2d 438, 164 USPQ 619 (CCPA 1970); and *In re Thorington*, 418 F.2d 528, 163 USPQ 644 (CCPA 1969).

A timely filed terminal disclaimer in compliance with 37 CFR 1.321(c) or 1.321(d) may be used to overcome an actual or provisional rejection based on a nonstatutory double patenting ground provided the conflicting application or patent either is shown to be commonly owned with this application, or claims an invention made as a result of activities undertaken within the scope of a joint research agreement.

Effective January 1, 1994, a registered attorney or agent of record may sign a terminal disclaimer. A terminal disclaimer signed by the assignee must fully comply with 37 CFR 3.73(b).

24. Claims 21-37, and 39-42 are rejected on the ground of nonstatutory obviousness-type double patenting as being unpatentable over claims 1-20 of U.S.

Patent No. 6,841,714. Although the conflicting claims are not identical, they are not patentably distinct from each other because:

Although the '714 claims do not include recycle of desorbent as the claimed invention, it would have been obvious to one skilled in the art at the time the invention was made to modify '714 claims and recycle the desorbent to the first adsorption column to reduce the make-up desorbent and make the process more economical;

Although '714 claims do not include dehydrogenation step, the claims do produce ethyl benzene. Since ethyl benzene is the starting material for the production of styrene, it would have been obvious to one skilled in the art at the time the invention was made to modify '714 claims and include a dehydrogenation step to convert ethyl benzene and produce styrene due to its importance as a polymer feedstock.

Allowable Subject Matter

25. Claim 38 is objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

The following is a statement of reasons for the indication of allowable subject matter:

A process according to claim 21 wherein second stream (23b) is hydrogenated and then conveyed to an isomerization zone, is not taught or fairly suggested in the prior art.

Response to Arguments

26. The Applicant argues that the Examiner cites no teaching or suggestion within either reference or any other evidence which would lead one skilled in the art to make these modifications. Furthermore, even if these modifications were made to the methods of Magne-Drisch, it would not result in the method claimed in claim 21.

The Applicant's argument is not persuasive because Magne-Drisch invention discloses that the ethyl benzene production line is generally integrated into a plant for producing styrene (See column 2, lines 35-37), but it does not disclose dehydrogenation step of ethyl benzene to styrene. Lee invention discloses an improved process for the dehydrogenation of ethylbenzene to styrene (see column 1, lines 9-12). Thus, it would have been obvious to one skilled in the art at the time the invention was made to modify Magne-Drisch invention by including a dehydrogenation step as suggested by Lee and take the stream (9) consisting of 99% pure ethylbenzene (See column 8, line 26) and convert it to styrene. Thus, the combined teachings of Magne-Drisch and Lee fully disclose claim 21 of the Applicant.

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27. The Applicant argues that contrary to the Examiner's suggestion that a pure stream of ethylbenzene be subjected to dehydrogenation, the dehydrogenation step of claim 21 is performed on a distilled raffinate product containing not only ethylbenzene but metaxylene and orthoxylene where the content of ethylbenzene is "minor" compared to the xylenes. There is no hint or suggestion within the cited references to perform a dehydrogenation step at such a stage in the production of ethylbenzene with such a feed stock. Therefore, claim 21 and all claims dependent thereon (claims 22-42) are unobvious. Applicants submit there are other features which distinguish the methods claimed herein from the disclosures within Magne-Dirsch and Lee, but this analysis is unnecessary.

The Applicant's argument is not necessary because the Applicant is producing styrene from ethylbenzene and then purifying to 99.8% purity by separating ortho and metaxylenes. Combined Magne-Dirsch and Lee inventions first separate ortho and metaxylens from ethylbenzene and then produce more than 99% pure styrene. See *Ex parte Rubin*, 128 USPQ 440 (Bd. App. 1959). See also *In re Burhans*, 154 F.2d 690, 69 USPQ 330 (CCPA 1946); *In re Gibson*, 39 F.2d 975, 5 USPQ 230 (CCPA 1930).

28. With regard to obviousness-type double patenting, the Applicant argues that No evidence has been presented to show or suggest it would be obvious for one skilled in the art to modify the subject matter of the '714 claims and include a dehydrogenation step to produce styrene. It is noted that the methods of the '714 patent are directed to the co-production of paraxylene and metaxylene at high levels of purity and not

ethylbenzene. While ethylbenzene is present in an intermediate fraction (11); based on the disclosure, this intermediate fraction is not pure and has a low concentration of ethylbenzene. The disclosure indicates that raffinate R2 (12) includes ethylbenzene but in amounts which can be less than 1% by weight. In view of the low concentrations of ethylbenzene, Applicants maintain that one skilled in the art would not be motivated to incorporate a dehydrogenation step into the methods of U.S. Patent 6,841,714 and would not have any motivation to incorporate such a step at the location in the step sequence recited in claim 21.

The Applicant's argument is not persuasive because patent '714 uses a typical feed stock with 5.6% ethylbenzene and the balance xylenes (See column 10, lines 41-49). Thus, a typical refinery will be using a substantial quantity of ethylbenzene, which has to be used. Styrene production being one of the most important uses of ethylbenzene, will motivate one skilled in the art to add a dehydrogenation step in the claim of '714 patent and thus make use of available stream of ethylbenzene to produce styrene along with purified xylenes.

Conclusion

29. **THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not


mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Prem C. Singh whose telephone number is 571-272-6381. The examiner can normally be reached on MF 7:00 AM-3:30 PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Glenn Caldarola can be reached on 571-272-1444. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

PS/061507


Glenn Caldarola
Supervisory Patent Examiner
Technology Center 1700